

## PATENT ABSTRACTS OF JAPAN

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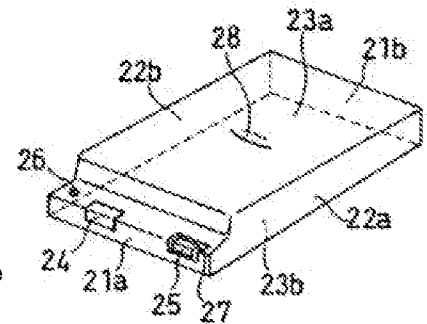
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### (54) SEALED THIN LITHIUM ION SECONDARY BATTERY

#### (57)Abstract:

PROBLEM TO BE SOLVED: To provide a sealed thin lithium ion secondary battery in which the drawn out direction of an outer terminal is not limited and a thinner battery pack than an existing one can be manufactured.

SOLUTION: This sealed thin lithium ion secondary battery has a flat battery case comprising a metal flat plate; a cover having a periphery part having almost the same shape as a periphery part of the metal flat plate; a power generating element comprising a positive electrode, a negative electrode, a separator, and a nonaqueous electrolyte, housed in the battery case; an outer terminal a connected to one of the positive electrode and the negative electrode and having the same polarity as the battery case; and an outer terminal b connected to the other of the positive electrode and the negative electrode and insulated from the battery case, and the cover has a wide side part parallel to the metal flat plate and almost perpendicularly crossing to the metal flat plate, and at least one of the outer terminal a and the outer terminal b is exposed to the outer surface of the peripheral side part.



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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the sealing thin rechargeable lithium-ion battery used for the power supply of a portable device etc.

[0002]

[Description of the Prior Art]The battery can with deep depth which has an opening of a long and slender rectangle is used for the conventional sealing thin rechargeable lithium-ion battery as a cell case. In this case, the group of electrode which consists of an anode, a negative electrode, and a separator is inserted from the opening of a battery can. Subsequently, a lid is inserted in the opening of a battery can and the open end of a battery can and the edge part of a lid are welded. The terminal of the anode or the negative electrode is provided in the lid via the insulation material, and the anode or negative electrode of these and a group of electrode is beforehand connected by the inside of the lid. An electrolysis solution is poured in from the inlet provided in the lid. A sealed battery will be completed if an inlet is finally closed by the sealing plug.

[0003]The flexible laminate film is also used as a cell case. In this case, a group of electrode is put between the laminate film of double fold, and hot welding of the edge part of a laminate film is carried out. The positive electrode lead and the negative electrode lead are beforehand connected to the anode and negative electrode of a group of electrode, respectively.

Those ends are pulled out from between the weldings of a laminate film as an external terminal.

An electrolysis solution is poured in in a case just before final hot welding.

[0004]The above-mentioned sealing thin rechargeable lithium-ion battery has the following problems. First, the battery can is manufactured by carrying out deep-drawing shaping of the aluminum plate etc. However, deep-drawing shaping of an aluminum plate etc. becomes difficult as slimming down of a cell progresses. When a battery can slims down, the work which inserts a group of electrode from a narrow opening becomes difficult, and there is a possibility of damaging a group of electrode during work. On the other hand, since the broad welding cost for carrying out hot welding of the edge part is needed, futility produces a laminate film to the space equipped with a cell. Since a laminate film laminates a thin resin film and metallic foil, its mechanical strength is weak and it tends to damage it.

[0005]Then, adoption of the flat cell case which consists of the flat metal plate 11 as shown in drawing 1, and the edge part of the flat metal plate 11 and the covering 12 fabricated by the vessel shape which has an isomorphism-like edge part mostly is proposed (JP,2001-250517,A). In the case of the cell shown in drawing 1, the group of electrode 13 is stored by the space of the vessel shape of the covering 12, and the cell is sealed by joining the edge part of the flat metal plate 11, and the edge part of the covering 12 by welding. compared with the battery can manufactured with deep-drawing shaping, manufacture is easy, and moreover, such a cell case is boiled markedly and is stronger than a laminate film. There is also no possibility of damaging a group of electrode during the work which stores a group of electrode to a cell case.

[0006]However, since the cell shown in drawing 1 has the positive pole terminal 14 and the negative pole terminal 15 only in the level flat part in which it was provided by one side of the covering 12, it is inconvenient in respect of the following. First, when the terminal of an anode and a negative electrode has turned to and exposed the extensive flank side of the covering 12 as mentioned above, there is a problem that the direction which pulls out an external terminal from a cell will be limited. When the cell shown in drawing 1 is equipped with an external circuit, it subsequently surrounds by an insulating material and a battery pack is manufactured, there is also a problem that a battery pack becomes thick. When this connects a cell and an external circuit at the time of pack manufacture, it is for carrying out spot welding of the lead board for a pack to the terminal of the anode and negative electrode which turned to the extensive flank side of the covering 12, and sticking an insulation sheet on the lead board of covering and the terminal of heteropolarity further. It is because a welding burr occurs in a nugget part when spot welding of the lead board for a pack is carried out, so only the thickness which accommodates a barricade is needed.

[0007]

[Problem(s) to be Solved by the Invention]This invention is made in order to cope with this situation, and it is a thing.

The purpose is to provide the sealing thin rechargeable lithium-ion battery which the direction to pull out is not limited but moreover enables manufacture of a battery pack thinner than before.

[0008]

[Means for Solving the Problem]This invention is a sealing thin rechargeable lithium-ion battery, and (1) flat metal plate, A flat

cell case which consists of covering which has an isomorphism-like edge part mostly with an edge part of said flat metal plate, and was fabricated by vessel shape, (2) A power generation element which consists of an anode, a negative electrode, a separator, and nonaqueous electrolyte which were accommodated in said cell case, (3) The external terminal a which is connected to either said anode or a negative electrode, and has the same polarity as said cell case. (4) -- it being connected with another side of said anode and a negative electrode, consisting of the external terminal b insulated with said cell case, and, [ and ] It has the circumferential flank formed so that said flat metal plate and said covering might cross at right angles mostly along an extensive flank parallel to said flat metal plate, and an edge part of said flat metal plate, and either [ at least ] the external terminal a or the external terminal b is related with a sealing thin rechargeable lithium-ion battery exposed to an outside surface of said circumferential flank.

[0009]Said covering has a stair-like or concave hollow which adjoins both said extensive flank and said circumferential flank, It is preferred that either [ at least ] the external terminal a or the external terminal b is exposed to both outside surfaces of said circumferential flank which adjoins an outside surface of a horizontal level and said horizontal level of said hollow parallel to said flat metal plate.

[0010]As for either [ at least ] the external terminal a or the external terminal b, it is preferred to have exposed to an outside surface of a corner part formed by said circumferential flank which intersects perpendicularly with a horizontal level of said hollow and said horizontal level mostly by the shape of L type.

[0011]the [ by which said circumferential flank adjoins said hollow ] -- the [ 1 short flank and / said ] -- the [ a long flank of a couple which intersects perpendicularly with 1 short flank, respectively, and counters mutually, and / said ] -- the [ 1 short flank and / which counters ] -- consisting of a 2 short flank is preferred.

[0012]An inlet of nonaqueous electrolyte is formed in a horizontal level of said hollow, and it is preferred that said inlet is plugged up with a sealing plug by laser welding.

[0013]As for an edge part of said flat metal plate, and an edge part of said covering, being mutually joined by laser welding is preferred.

[0014]As for the external terminal b, it is preferred to be insulated with said cell case via a gasket.

[0015]

[Embodiment of the Invention]The perspective view of the sealing thin rechargeable lithium-ion battery concerning an one embodiment embodiment is shown in drawing 2. the [ which the flat cell case of this cell counters ] -- the [ the 1 extensive flank 23a and ] -- it consists of the 2 extensive flank 23b, and these extensive flank and the circumferential flank of the frame shape established almost vertically. the [ to which the external terminals 24 and 25 exposed said circumferential flank ] -- the [ the 1 short flank 21a and ] -- the [ the 1 short flank 21a and / which counters ] -- it consists of the 2 short flank 21b, and the 1st merit flank 22a and the 2nd merit flank 22b which intersect perpendicularly with each short flank and counter mutually.

[0016]One side of the anode and negative electrode which were stored in the cell case is electrically connected with the external terminal 24 soon provided on the cell case, and the electrode of another side is connected with the external terminal 25 insulated with the cell case via the gasket 27 by the inside side of a cell.

[0017]this cell case -- the -- the [ the 1 short flank 21a and ] -- having a stair-like hollow which adjoins both 1 extensive flanks 23a -- the [ the horizontal level of said hollow, and ] -- the external terminals 24 and 25 are exposed to the corner part formed by the 1 short flank 21a by the shape of L type. The inlet 26 of nonaqueous electrolyte is formed in the horizontal level of said hollow. This inlet will be plugged up with a sealing plug by laser welding after pouring in of nonaqueous electrolyte finishes. the -- the safety valve 28 is formed in the center of the 1 extensive side 23a of grooving.

[0018]Next, the I-I line sectional view of the exploded perspective view of the same cell, an important section plan, and said important section plan is shown in drawing 3, drawing 4, and drawing 5, respectively. A cell case comprises the covering 32 which has a shallow vessel shape space for having an isomorphism-like edge part mostly with the edge part of the flat metal plate 31 of approximately rectangular shape, and the flat metal plate 31, and storing the group of electrode 33.

[0019]As for the flat metal plate 31, it is preferred that it is 0.08-0.3 mm in thickness. When a cell case has the same polarity as an anode, the flat metal plate 31 Aluminum, Consisting of an aluminum alloy, a Magnesium alloy, etc. is preferred, and as for the flat metal plate 31, when a cell case has the same polarity as a negative electrode, it is preferred to consist of nickel, nickel plate steel, stainless steel, a titanium alloy, etc. Although not illustrated by the periphery end of the flat metal plate 31, the welding margin of constant width may be provided in it.

[0020]The covering 32 consists of the same material as the flat metal plate 31, and it is preferred that it is 0.08-0.3 mm in thickness. Although not illustrated by the periphery end of the covering 32, the welding margin of the constant width doubled with the shape of the welding margin provided in the edge part of the flat metal plate 31 may be provided in it.

[0021]Since the flat metal plate 31 and the covering 32 can be easily manufactured by the fabricating operation of a metal plate, they are the optimal to a 3 mm or less-thick thin cell. [ of the cell case which comprises these ] Moreover, since the cell case which consists of the flat metal plate 31 and the covering 32 has sufficient intensity of the conventional deep-drawing can average, it does not have the worries about breakage etc.

[0022]The safety valve 28 shown in drawing 2 can be formed in a cell case by forming the slot of a prescribed pattern in a metal plate. If the internal pressure of a cell rises, it is a mechanism in which the slot which is thin [ the thickness of a member ] cleaves. In the clad plate which assigned the thin metal plate there, the portion which consists only of a thin metal plate serves as a safety valve from \*\*\*\*\* in some metal plates.

[0023]The group of electrode 33 accommodated in a cell case winds a band-like anode and negative electrode around an ellipse cartridge via a separator. What is used for the nonaqueous electrolyte secondary battery from the former can be especially used for an anode, a negative electrode, and a separator without limitation. Generally an anode contains lithium

containing transition metal oxides, such as cobalt acid lithium, manganic acid lithium, and nickel acid lithium, as an active material. Generally the negative electrode includes carbon materials, such as black lead.

[0024]The leads 34 and 35 are connected to each electrode, respectively, and the other end of the lead 34 is welded to the arbitrary positions of a cell case. The other end of the lead 35 is welded to the metal rivets 36. The rivet 36 is in the state where it was insulated with the covering 32 by the intervention of the lower gasket 37 which pinches the covering 32, and the upper gasket 38. The tip part which the projection of the rivet 36 passed the hole provided in the lower gasket 37, the covering 32, the upper gasket 38, and the washer 39, respectively one by one, and was projected from the hole of the washer 39 is closed to the peripheral face of the hole of the washer 39. Since the fixed gap 51 is formed between the flat metal plate 31, the flat face of the rivet 36 which counters, and the flat metal plate 31, a cell case and the rivet 36 will be in the state where it was insulated thoroughly.

[0025]The tip of the washer 39 and the rivet 36 serves as an external terminal of one electrode. since the section of the washer 39 is L type-like -- the [ the horizontal level of the stair-like hollow of a cell case, and ] -- it has fitted into the outside surface of the corner part formed by 1 short flank via the upper gasket 38. Thus, in the case of the external terminal exposed to the outside surface of a corner part by the shape of L type, the direction which pulls out an external terminal is not limited. The above-mentioned terminal structure is suitable for manufacture of a battery pack thinner than especially the former.

[0026]the positions of a cell case with an arbitrary external terminal of another side which, on the other hand, has the same polarity as a cell case, for example, the, -- the [ the outside surface of the 2 short flank 21b, the outside surface of the horizontal level of a stair-like hollow or said horizontal level, and ] -- it is provided by sticking a metal piece on the outside surface of the corner part formed by 1 short flank by welding etc. For example, when a cell case is an anode, the clad plate of aluminum and nickel, etc. are used as said metal piece.

[0027]The perspective view of the sealing thin rechargeable lithium-ion battery concerning a two embodiment embodiment is shown in drawing 6. the flat cell case of this cell -- the -- the [ the 1 short flank 61a and ] -- the concave hollow which adjoins both 1 extensive flanks 63a, [ have and ] the [ the horizontal level of said hollow, and ] -- the external terminal 65 which has different polarity from a cell case is exposed to the outside surface of the corner part formed by the 1 short flank 61a by the shape of L type via the gasket 66. The composition of this Embodiment 2 is the same as that of Embodiment 1 except the shape of the hollow established in the cell case being a concave.

[0028]Since the space for storing the power generation element within a cell case becomes large when the shape of the hollow established in the cell case is a concave, cell capacity becomes large. Therefore, according to this embodiment, the direction which pulls out an external terminal is not limited, and also it becomes possible to obtain a thin cell with big capacity.

[0029]As for the external terminal which has the same polarity as a cell case, since the horizontal level of a concave hollow has a small area compared with the horizontal level of a stair-like hollow, providing in other parts is preferred. the [ for example, ] -- the [ the 1 short flank 61a or ] -- the [ the outside surface of the 2 short flank 61b, and ] -- the [ of the 1 short flank 61a neighborhood ] -- the [ the outside surface of the 1 extensive flank 63a, or ] -- the [ the 1 short flank 61a and ] -- the crevice for board thickness can be formed in the outside surface of the corner part formed by the 1 extensive flank 63a, and a terminal can be provided there.

[0030]Although the above-mentioned embodiment explained the case where the external terminal was exposed to the outside surface of both the horizontal level of a stair-like or concave hollow, and a short flank, the cell which exposed the external terminal only on the outside surface of the short flank is also feasible. The cell which can apply this invention is not restricted to the cell of approximately rectangular shape, but can apply this invention to the cell which has shape similar to this similarly.

[0031]

[Effect of the Invention]As mentioned above, as explained in detail, in the sealing thin rechargeable lithium-ion battery concerning this invention, manufacture of the flat metal plate which constitutes a cell case, and covering is easy, and sufficient intensity can be obtained. The direction which pulls out an external terminal is not limited but it becomes possible to manufacture a battery pack thinner than before moreover.

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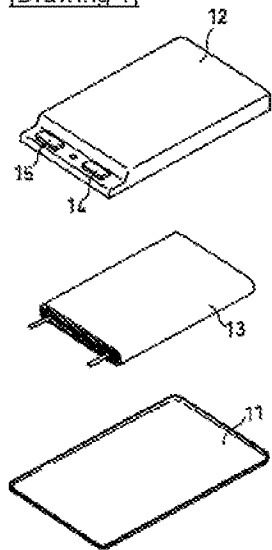
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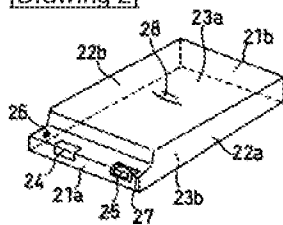
DRAWINGS

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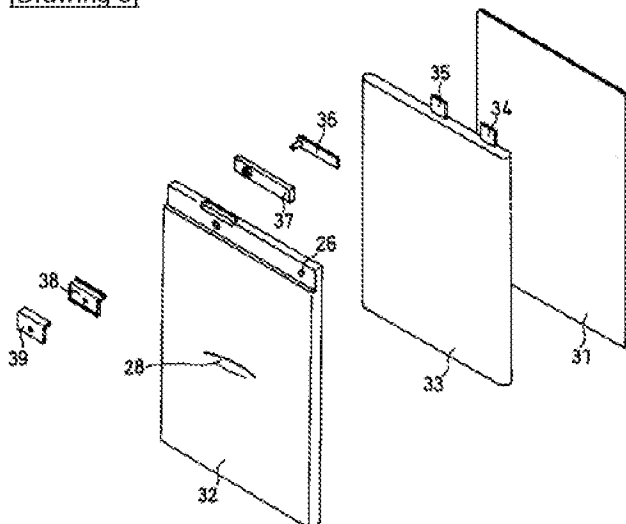
[Drawing 1]



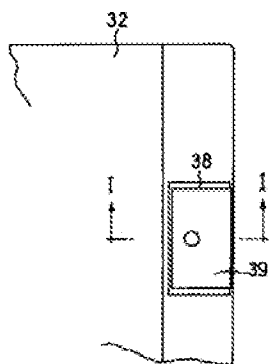
[Drawing 2]



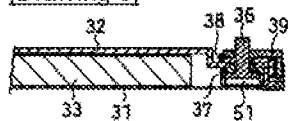
[Drawing 3]



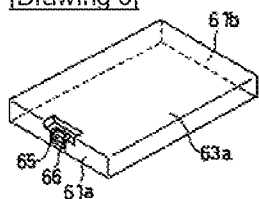
[Drawing 4]



[Drawing 5]



[Drawing 6]



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